

Pending: Addendum to the QAPP, Version 1.1 for the following project: Protecting Puget Sound Watersheds from Agricultural Pollution Using a Progressive Manure Application Risk Management (ARM) System

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The following information on groundwater monitoring will be added to the current QAPP via an addendum pending funding and methods approval. In addition to what is listed below, additional language will be added throughout the QAPP indicating that groundwater monitoring will be conducted. The QAPP addendum will be vetted through the review and approval process following addition of the groundwater monitoring section.

6.3. Phase 3: Implementation and Monitoring

Table 6.1. Summary of analyses for each medium sampled

Ground Water
Laboratory
FC, total-N, total kjeldahl nitrogen (TKN), nitrate, ammonium, total-P
Field Equipment
Dissolved oxygen, temperature, conductivity, nitrate, ammonium, pH, and redox; Multi-parameter probe, impulse pump, flow-through cell

10.3. Sample Types, Locations, and Frequencies

10.3.8. Ground-Water

Groundwater data will be collected from shallow wells (6-10 feet), which completely screen the interval from 2-feet below ground surface to the deepest expected water-level stand during the annual cycle. For each 10-acre test plot, 4-6 wells will be installed to provide spatial coverage and to assess the variability in the chemical composition of the upper-most water-bearing zone. The wells will be located so as to accurately assess both the background (up-gradient flow) concentrations and contributions directly from the test plot area to groundwater. Given the shallow ground-water and soil characteristics of the area, these wells are expected to be installed as hand driven well points. Low-flow sampling will be utilized to collect the water from the top of saturation. Chemical samples will be collected first, followed by more extensive pumping through a flow-through cell for the measurement of field parameters such as oxidation-reduction

potential (Eh or Redox), DO, conductivity, temperature, nitrate, ammonium, and pH. The timing of each groundwater sampling event will coincide with the other samples collected.

11.1. Sample Collection, Preparation, and Decontamination Procedures

11.1.8. Ground-Water

Groundwater data will be collected in the field using a flow-through cell and multi-parameter probe (YSI Pro-Plus). The pump can be an impulse type or peristaltic using Low-Flow sampling technique. Samples will be transferred from the collection vessel into 120 ml (FC, lab) and 250/1000 ml (lab and field) sterile environmental testing bottles provided by the state-certified testing laboratory. For the laboratory samples, a 250 ml sample will be collected for each individual analyte, or a 1000 ml sample for all analytes (depending on test being conducted). The lab sample will be capped immediately, taking care not to touch the lip of the bottle or inside of the cap, and placed in a chilled (≤ 6 °C), UV protected cooler. Samples to be analyzed for total phosphorous, nitrate-nitrite, and/or ammonia nitrogen will be acidified with sulfuric acid (H_2SO_4) to $\text{pH} < 2$ for preservation. For in-field direct analysis, the clean YSI probe will be inserted into well for real-time analysis. All results will be recorded by the meter as well as entered into a field notebook. Lab samples will be stored in a chilled (≤ 6 °C) cooler and taken to the laboratory for analysis the same day. If same day drop off is not possible, samples will be stored in a refrigerator overnight and taken to the laboratory within 24 hours of attainment. A field replicate, treated in the exact same way, will be taken every twentieth sample for lab samples and sent for analysis. Field samples will be split every twentieth sample and analyzed for variability (Table 14.1).

Depth to water from the top of casing will be recorded for each well.